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ABSTRACT

Our understanding of a story is highly dependent upon our ability to recognize the underlying purpose for actions described in the story. We need to view those actions as steps in, or reactions to, plans. This paper sketches some of the components of a model for the understanding of plans and social actions. The model is first applied to narrative text, wherein actions of characters need to be interpreted as social actions. The emphasis on social actions and plans leads to a distinction between "story analysis" and "story model analysis" (that is, analysis of a reader's model for the story). Next, the model is applied to texts in general, wherein the author's action of writing needs to be interpreted as an action performed to achieve a social goal. Finally, the paper discusses implications for teaching and further research. (Author/AA)

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CENTER FOR THE STUDY OF READING

Technical Report No. 34

PLANS AND SOCIAL ACTIONS

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Abstract

Our understanding of a story is highly dependent upon our ability to recognize the underlying purpose for actions described in the story. We need to view those actions as steps in, or reactions to plans. Furthermore, we need to interpret them with respect to our beliefs about the world, including our beliefs about the beliefs held by the characters. Similarly, our understanding of texts in general is strongly influenced by our beliefs about the purposes of the author.

This paper examines the skills and knowledge needed to understand plans and social actions. Following a general discussion of the issues, there are applications of a plan and social action analysis to understanding episodes and understanding author's intentions.

Outline

1. Introduction - A Functional View of Language 3

2. Interpreting Actions 5

3. Understanding in Terms of Plans and Social Actions 10

3.1 Plans and Goals 10
3.2 Social Actions 12
3.3 Beliefs 15
3.4 Patterns of Behavior 16

4. Understanding Narrative Text 19

4.1 Story Analysis 19
4.2 Story Model Analysis 25

5. Understanding the Author's Intentions 32

6. Implications for Teaching 36

7. Further Research 38

1. Introduction - A Functional View of Language

Viewing an action as a step in a plan provides an organizational schema for events in the social world just as the concept of physical causality does for events in the purely physical world. Because the perception of plans plays a central role in our structuring of reality, it may account for many reading comprehension difficulties. The person who has difficulty in recognizing plans and social actions in the behavior of others will have difficulty in understanding episodes related in written form. The person who can understand episodes in daily life will still have difficulty if he or she cannot understand the connection between purposeful behavior and its conventional linguistic expression. The person who does not understand the communicative intent of a text will have a serious comprehension problem. Thus, the recognition of plans has implications for understanding the actions of characters in a narrative as well as understanding the action performed by an author.

Plans and social actions have been the focus of work in social psychology [Heider, 1958], cognitive-social psychology [Schmidt, 1976], developmental psychology [Piaget, 1932;

Sedlak, 1974]; philosophy [Austin, 1962; Searle, 1969, 1975, 1976a,b], psycholinguistics [Clark and Lucy, 1975], sociolinguistics [Sudnow, 1972], linguistics [Gordon and Lakoff, 1971; Sadock, 1974], and artificial intelligence [Bruce, 1975; Cohen and Perrault, 1976; Schmidt and Sridharan, 1976]. This work has shown first, that understanding plans is a critical part of understanding actions; second, that the ability to understand plans is one of the most complex inferential tasks that people accomplish; and third, that, perhaps because of the inherent complexity, children require many years to develop the needed skills. These years include the ages when the transition to skilled reading is assumed to occur.

This paper sketches some of the components of a model for the understanding of plans and social actions. The model is first applied to narrative text, wherein actions of characters need to be interpreted as social actions. The emphasis on social actions and plans leads to a distinction between <u>story analysis</u> and <u>story model analysis</u> (i.e., analysis of a reader's model for the story). Next, the model is applied to texts in general, wherein the author's action of writing needs to be interpreted as an action done to achieve a social goal. Finally, the paper discusses implications for teaching and further research.

2. Interpreting Actions

A person learns to interpret events in the world in ways that reflect different explanatory systems. A given event may have, for example, both a physical and a biological interpretation. When the events are actions performed by people, additional explanatory systems become relevant. In particular, conventional interpretations of personal actions go beyond physical and physiological levels to include notions like "rule", "goal", and "intention". In this paper we will be most concerned with the levels of explanation for personal action that include these latter notions. The following example should clarify what is meant here.

Imagine that you observe a person named Susie perform an action. At one level you might describe her action as "Susie moved her arm up and down causing a paint brush to move while in contact with a chair until the chair was covered with paint". At a second level you might describe her action in terms of an organizing concept, e.g., you could say "Susie is painting the chair", thus both summarizing and reinterpreting the action described above. You could also describe Susie's action as "helping Martha paint" if it satisfies a set of rules which constitute the definition of "help". That "help"

must be defined by a set of rules about beliefs becomes clear when we consider what it is about Susie's action that makes us view it as a helping action. Certainly it is more than just the physical-physiological facts or even the propositional content of her act, for the same action could also be seen as a "harming", or an "exploiting". We have to know that Martha had a goal of painting the chair, that this goal satisfied some want or need of Martha, that Susie believed that Martha had the painting of the chair as a goal, etc.

An action may be described at a variety of levels. The three outlined above are merely indicative of this fact. As we have seen, a "moving of a paint brush", a "painting", and a "helping" are not different acts but different ways of conceptualizing the same act [cf. Bobrow and Winograd, 1977; Moore and Newell, 1973]. The concept of "moving a paint brush" differs from the concept of "helping" in that the rules for its use are primarily physical-physiological, while the rules for "helping" are primarily social. This is not to say that there are no physical-physiological correlates of a particular instance of "helping", but only that the concept summarizes a set of beliefs about the goals and beliefs of an actor. The level of beliefs cannot in principle be reduced to the physical-physiological level, but even if it could, it

appears that people's reasoning about actions (and hence the language they use to discuss actions) does not make that reduction. Some definitions of actions at the intentional level are given in [Bruce, 1975].

One implication of the different aspects of actions is that stories can be understood by linking together actions at different levels. As Christie and Schumacher [1975] have shown (for children in grades K,2,5) the degree of connectivity (or "relevance") of an idea unit to the main line of a story has significant effects on the likelihood of its recall. Children may have difficulty in the interpretation of an action at a given level or in the connections to be made to other actions. They may even have difficulty in determining what action (at the social level) is being carried out. For example a speaker might be asking a question, giving an order, or making a statement; a painter might be helping or harming.

The ability to interpret actions in terms of their presumed purpose begins to develop early in one's life but improves over many years. In fact, the expression of intention begins before a child begins to speak [Bruner, 1966, 1973], is evident at the single-word utterance stage [Dore, 1974], and is elaborated over many years of development to the

complexities of adult language use [Shatz, 1977; see also the analysis of "promise" in Searle, 1969].

The interpretation of intentions is perhaps a different matter. Piaget [1932] noted that younger children appear to make blame and praise judgments more on outcomes of actions than on the apparent intention behind them, whereas older children rely more on intent. Whether this observation reflects a difference in the criteria for moral judgments or a difference in perceived intentions is difficult to determine, but recent studies [Feldman, et al., 1976; Sedlak, 1974] suggest that the complexity of problem solving required to perceive intentions, and therefore the memory and processing demands on the child, results in differences in the perceived intention. Berg-Cross [1975], for instance, suggests that even 6-year old children are capable of responding to the level of intentions behind actions in a story. It appears that younger children can perceive intentions and do use that perception in evaluating actions, but they have difficulty in constructing the elaborate hypotheses about plans that are sometimes needed.

The reason why our ability to interpret actions (or take on other roles) takes time to develop is still an open

question. Given the complexity of the necessary skills (see below), it is not surprising that the development of the ability to understand intentions takes years to develop. Furthermore, the knowledge required must be accumulated from a variety of sources including one's own plan formulation and interactions with others. Such things as the types of objects and people affected in stories have been shown to have effects on children's judgments of intentionality [Imamoglu, 1975; Berndt and Berndt, 1975]. The years when one learns the appropriate conventions include the years when the transition to skilled reading is assumed to occur.

Among the skills and knowledge needed to interpret actions at the intentional level are the following:

(1) The ability to plan, i.e. to formulate a sequence of actions leading to a goal [Sacerdoti, 1975], and to recognize the actions of others in terms of their presumed goals. The effect of the actions may be to reach the goal, to enable other actions, or to motivate someone else to act (or not to act) [Schmidt and Sridharan, 1976].

(2) Knowledge of how certain social actions are typically carried out (e.g., "giving" often involves a physical transfer). Knowledge of the preconditions and outcomes of

actions at all levels. Knowledge of the normative behaviors associated with social actions and situations. Knowledge of social situations and the roles people take.

(3) The ability to distinguish one's beliefs from one's beliefs about another's beliefs; also, the ability to handle possibly inconsistent data about the beliefs and plans of others.

(4) Knowledge of social action patterns, i.e., the sequences that typically occur.

These are discussed in the next section.

3. Understanding in Terms of Plans and Social Actions

3.1 Plans and Goals

We learn early in life to interpret actions in terms of their purposes. What must we know to understand the purpose behind someone's behavior? Heider [1958] answers with the postulate that deciding that a person has performed (caused) an action (or outcome) commits us to the judgments that he or she can cause the action (or outcome) and is motivated to do so:

$$\text{cause}(p,x) \Rightarrow \text{can}(p,x) \;\&\; \text{try}(p,x)$$

where p is a person and x is an action. "Motivation" should be taken here in the general sense that the outcome (as

perceived by the actor) facilitates (in the actor's mind) the attainment of some goal of the actor. For example if someone, who is observed to be holding a box that is wrapped in fancy paper with a ribbon, places that box in someone else's hands, then we may assume that the first person gave a present. Symbolically, if the persons are labeled p1 and p2, and the box, b, we would have

cause (p1, give (p1,p2,b))=> can (p1, give (p1,p2,b))
& try (p1, give (p1,p2,b))

Rules for the try component of Heider's axiom essentially resolve to common-sense notions of why people do things [Schmidt, 1976], since it is at that level where persons reason about the actions of others.

The can component of Heider's axiom says that if a person causes an action then he or she can do that action. Being able to do something may mean that certain physical and skill conditions are met. But it may also mean that these conditions can be brought about. Thus we may infer that "Henry can go to the store" if he can drive his car there; he can drive his car if he can find the keys; he can find the keys if he can find the pants he left them in, and so on. In other words, we want to say that a person can do something if he or she can do it directly, or can do some other action that enables it to be done directly.

But the problem is even more complicated. Someone else may be able to enable the action. In that case, the first person will succeed if he or she can motivate (cf. the try component) the second person to enable the action. This means that the perception of a purposeful act may require the observer to simulate the planning process of the actor, and, in so doing, simulate the planning process of a third party. Plan perception and plan generation are thus inextricably linked, in a way that accounts for much of the difficulty for each task, and hence for the perception of intentions.

In order to do plan recognition (and hence, simulation of the planning behavior of other) a reader must possess a set of well elaborated types of knowledge and processing abilities, [Schmidt and Sridharan, 1976]. The coordination of these abilities forces a reader into a hypothesis based mode of comprehension [cf. Goodman, 1973], in which perceived plans are constantly being evaluated and refined.

3.2 Social Actions

Recognizing a social action involves knowing its typical realizations as well as its internal structure. For example, "buying" implies beliefs about ownership and free exchange, and it has a typical realization in terms of money and object

transfers. Understanding an action also implies knowing what conditions are appropriate for an action to occur (the preconditions) as well as what is typically true afterwards (the outcome conditions). Children may fail to discover the structure of a story if they fail to generate all the outcomes of an action, including the implications of outcomes. For example, "Sally made the third out" has as one of its outcomes the fact that the inning is over. They may also have trouble if they fail to generate all preconditions of an action. The example above presupposes that Sally is playing a game of baseball. Finally, one must discover connections between preconditions and outcomes of actions in order to construct a connected sequence of actions which follow from one another. Section 4.2 shows that these links between actions are crucial for understanding even a simple story.

A special case of actions that require interpretation at the intentional level is the speech act, or more broadly, the linguistic act. Like other social actions, speech acts can be described at various levels. At the physical-physiological level we have the "utterance act" [Searle, 1969]. For example, an utterance act might have the description

Betsy uttered the sounds,
/' th a t/ /' p l a n t/ / i s/ /' s i k/

A speech act also can be given a propositional description. Continuing our example we could say that Betsy's statement refers to the "that plant" and predicates "is sick".

Speech acts also have intentional descriptions, or in Austin's [1962] terminology, "illocutionary force". If we believe that Betsy believes her statement, that she believes she has evidence for it, that she believes that it is not obvious to her listeners that the statement is true, that she wants her listeners to believe the statement, and perhaps other conditions, then we might describe her act as "asserting". At yet another level we might describe her action in terms of its role in a larger plan, e.g., as the answer to a question or as part of a general informing plan. As is the case for social actions in general, there are higher level descriptions for speech acts that depend more and more upon beliefs and social conventions.

Recent work [Schweller, Brewer and Dahl, 1976] has shown that people tend to remember the underlying illocutionary force of an utterance, often at the expense of its literal form. In fact, even the perlocutionary effects (e.g., if I "threaten" you may become "frightened") may lead to false recognition errors. Processing at the intentional level is

thus apparently automatic at times. It is not known how successful children are at this intentional processing, particularly with respect to text, where the cues become more abstract and subtle, where the complexity in terms of actors and goals increases, and where very indirect forms need to be interpreted in terms of multiple intentions.

3.3 Beliefs

In order to recognize another's intentions we need to take his or her perspective on the world. Kohlberg [1969] and Selman [1971] have shown that role-taking is correlated with the ability to make sophisticated moral judgments (i.e., judgments based on the perceived purpose of an action). Yussen [1976], studying subjects in grades 9, 10, 12, and college, found that differentiation among social roles increases even at those ages.

Taking another's perspective is one of several complexities in memory organization that are required for understanding plans and social actions. Problems are such as: How do we account for the ability to take another's perspective when that perspective may entail taking our perspective again? How many levels of perspective taking are there? [Strawson, 1964; Schiffer, 1972]. How do we represent

the dependence of one belief on others? How do we represent differing certainties about beliefs? One thing needed is a memory in which items become true ("visible") in certain contexts [Cohen and Perrault, 1976]. For example, that Boston is cold in January may be true in my world, and in my view of your world, but perhaps not in my view of your view of my world. See Section 4.2 for a further discussion of embedded beliefs. These problems are only part of the entire issue of beliefs and their role in comprehension.

3.4 Patterns of Behavior

One way in which a person can cope with the complexities inherent in social action (and speech act) recognition is to look for patterns of interactional behavior. Patterns recur because the outcomes and preconditions of certain actions match each other. As a sequence of actions unfold the conditions for subsequent actions to occur may change. Thus previous actions play an important role in determining the environment for later ones. Action patterns represent summaries of many sequences of action; thus, they are efficient though occasionally faulty mechanisms for predicting or accounting for behavior. Some patterns have a simple and explicit goal-orientation, but others (like the

teaching/learning pattern below) may not. Abelson [1975] uses the term "script" for the general pattern and "plan" for the goal directed pattern.

There are a multitude of action patterns which fit the description given above. One special type includes patterns that have become ritualized, often embedded in the language. For example, the interchange -

"Hello!"
"Hi! How are you?"
"Fine; and you?"

could be a typical greeting. It is not difficult to imagine a grammar for such greetings which generates many of the patterns we use [cf. Becker, 1975]. Furthermore, it is clear that the words in these patterns have lost much of their original significance. We usually do not want a graphic answer to the greeting "How are you?". Instead, the phrase is serving as an unanalyzed symbol in the "greeting" grammar. Fillmore [1971] shows, however, that even these rituals can only be heuristics for action, and not conditioned responses.

A richer example of a behavior pattern is one which might be observed in a school or other teaching and learning

situation. This pattern includes talking, writing on paper or a blackboard, and possibly a lot of gesturing or silences for thinking. Furthermore the content of the talking and writing is constrained. We might expect many questions and answers by both the teacher and the student. On the other hand, commands might be less common. See Hall [in press] and Hall & Freedle [1975] for a discussion of these conventions and the difficulties they may cause.

An important feature of any behavior pattern is that it cannot be applied in all situations, i.e., that there are implicit constraints on its applicability. The greeting pattern occurs only upon meeting someone; a waiter/customer pattern exists only in a restaurant; a boss/employee pattern exists only in the work situation; and even the teaching/learning pattern applies only when we infer certain conditions. But the pattern also changes the conditions for interaction in that mutual recognition of a pattern leads to shared expectations and beliefs about the interactions. The importance of social learning is evident here as a prerequisite to effective use of these action patterns in comprehension.

4. Understanding Narrative Text

4.1 Story Analysis

The connectivity of a story can be illustrated via a story grammar in much the same way that the structure of a single sentence can be illustrated by a sentence grammar. Rumelhart [1975] and others (Sutton-Smith, et al., 1976; Stein & Glenn, 1977; Mandler & Johnson, 1977) have shown that such grammars can account for the relative salience of parts of a story. In this section I want only to sketch the use of story grammars (or story schemas) and to point to both their usefulness and limitations.

For the purpose here we will use the following story taken from the first Winston reader [Firman & Maltby, 1918]:

THE DOG AND THE COCK

1. Once a dog and a cock went into the woods.
2. Soon it grew dark.
3. The cock said, "Let us stay here all night. I will sleep in this tree-top. You can sleep in the hollow trunk."
4. "Very well," said the dog.
5. So the dog and the cock went to sleep.
6. In the morning the cock began to crow, "Cock-a-doodle-do! Cock-a-doodle-do!"
7. Mr. Fox heard him crow.
8. He said, "That is a cock crowing. He must be lost in the woods. I will eat him for my breakfast."
9. Soon Mr. Fox saw the cock in the tree-top.

10. He said to himself, "Ha! ha! Ha! ha! What a fine breakfast I shall have! I must make him come down from the tree. Ha! ha! Ha! ha!"
11. So he said to the cock, "What a fine cock you are! How well you sing! Will you come to my house for breakfast?"
12. The cock said, "Yes, thank you, I will come, if my friend may come, too."
13. "Oh yes," said the fox. "I will ask your friend. Where is he?"
14. The cock said, "My friend is in this hollow tree. He is asleep. You must wake him."
15. Mr. Fox said to himself, "Ha! ha! I shall have two cocks for my breakfast!"
16. So he put his head into the hollow tree.
17. Then he said, "Will you come to my house for breakfast?"
18. Out jumped the dog and caught Mr. Fox by the nose.

Rumelhart [1975] proposes a simple grammar to account for the structure of children's stories such as this. (He uses a different formalism in more recent work [Rumelhart, in press].) Here are the syntactic rules for his grammar:

```
Story -> Setting + Episode
Setting -> (States)*
Episode -> Event + Reaction
Event -> {Episode ¦ Change-of-state ¦ Action ¦ Event + Event}
Reaction -> Internal Response + Overt Response
Internal Response -> {Emotion + Desire}
Overt Response -> {Action ¦ (Attempt)*}
Attempt -> Plan + Application
Application -> (Preaction)* + Action + Consequence
Preaction -> Subgoal + (Attempt)*
Consequence -> {Reaction ¦ Event}
```

The grammar can be read roughly as follows: "A story consists of a setting and an episode (we might generalize this for the dog and cock story to 'episodes'). Each episode comprises an event and a reaction to the event. Events can be episodes

themselves, changes of state, actions, or pairs of events. And so on. When we apply the grammar to a story we get a tree structure representation. The portion of the resulting tree for segments 8-11 of "The dog and the cock" is shown in Figure 1. The numbers refer to the segments of the story as given above.

Given a grammatical representation for a story one can make predictions about recalls and summaries based on the structural relevance of parts of the story. Segments coded as internal responses, for example, or deeply embedded segments, may be less easily remembered. Stein & Glenn [1977] and Mandler & Johnson [1977] have done work along these lines. Rather than consider that work in detail, I want to make general observations here about some characteristics of a story grammar analysis. (I believe that similar comments apply to analyses in terms of Abelson's [1975] and Schank's [1975] scripts and plans, but I will restrict the example to the kind of story schema presented here.)

When one attempts to apply a story grammar it soon becomes apparent that the interpretation of a segment of the story can vary. For example, I coded (11), inviting the Cock to breakfast, as an action to achieve the overall goal stated

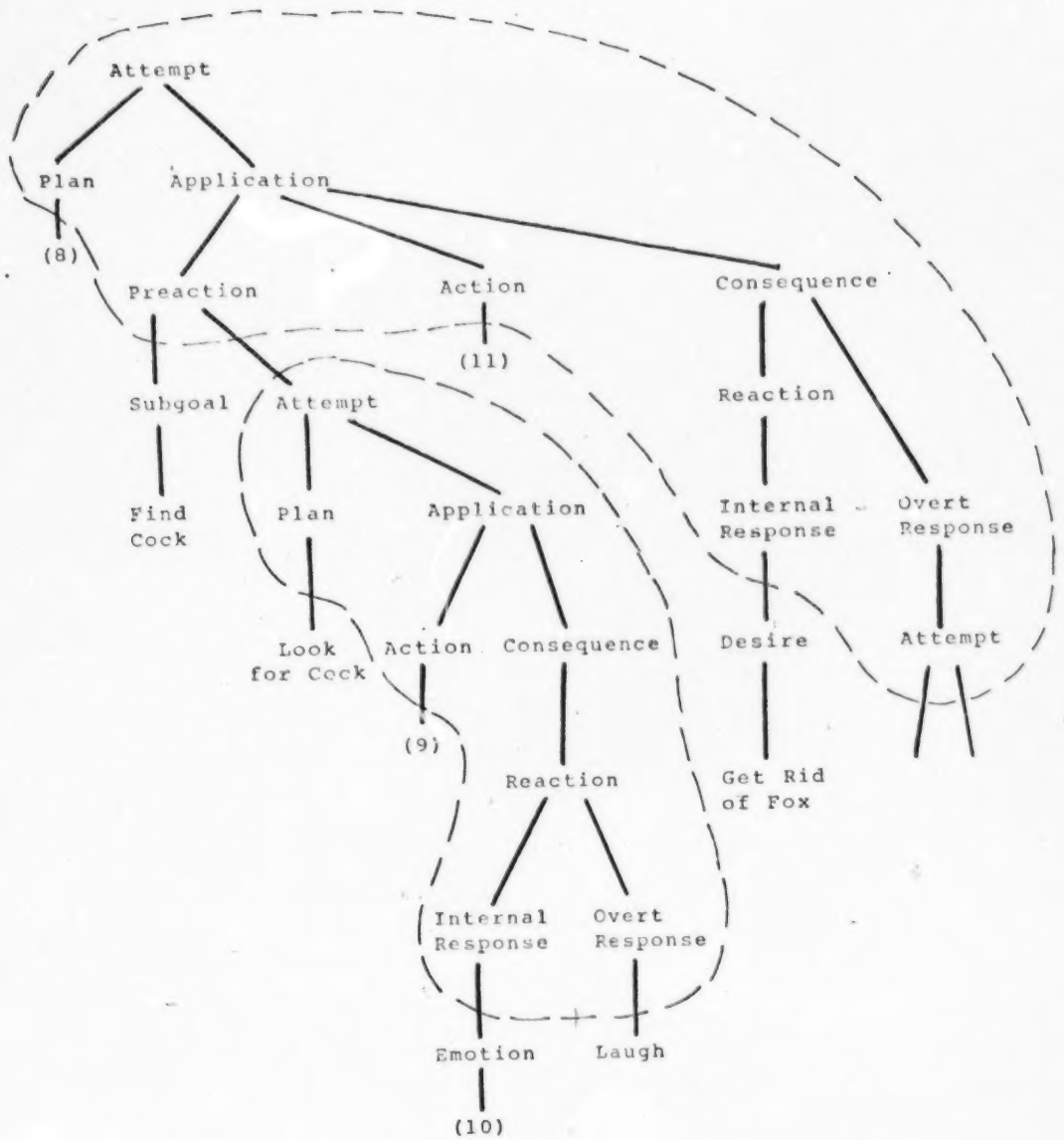

Fig. 1. A story grammar account of a portion of "The dog and the cock."

in (8), eating the Cock; but it could have been viewed as part of the overt response to (9), finding the cock. Furthermore, the choices made by the "grammar applier" in assigning structures are evident only in the final product, the tree representation. For purposes such as predicting free prose recall performance the alternative structures given by the grammar may be equivalent. If our goal, however, is to account for variations in a child's model of a story, then we need a representation system that makes more of these choices explicit.

In a story such as "The dog and the cock", which has two protagonists, we see a repeated pattern in the tree analysis (see Figure 2). This pattern appears whenever one character acts in response to an action of the other. In dialogues, or in general, in stories whose characters have independent, but interacting plans, one would expect to find this pattern. Unfortunately, we cannot view here the entire tree structure for our example story, for in it one could see the flow of these patterns, each showing <plan>-<action>-<internal response>-<overt response>-<plan>- etc. The story grammar is a reasonable way to label this flow, but it says nothing about the processes which generate it. The reason is that each character's plan is based upon that character's beliefs about

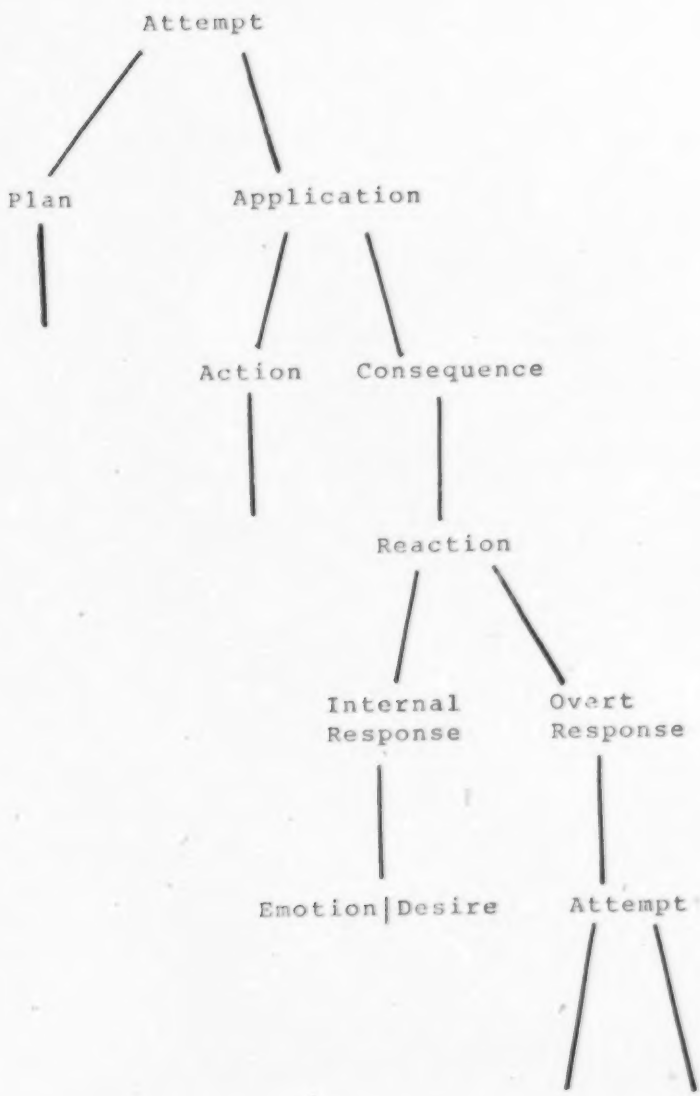

Fig. 2. A common pattern found in the story grammar analysis of "The dog and the cock."

ways to attain his or her goals. Thus the processes that account for a <plan>-<action>-<internal response>-<overt response> sequence must be explained in terms of a model of the character, not just the story itself.

A final point is that the story grammar cannot show how elements of a setting or an internal response are linked to the plans and actions of the characters. I would expect that setting and internal response information is easily lost unless it is critical to the account of a plan. A representation that made these links explicit could be used to predict relative salience of those non-action parts of a story.

4.2 Story Model Analysis

The preceding section discusses a method of story analysis that explains some important features of stories. The method has an important limitation, in that it simply ignores the internal structure of plans, and hence of the beliefs of characters about actions that occur. The best way to show this is to present an alternative analysis that explicitly incorporates the structure of plans, beliefs and social actions.

For comparison purposes we will again use "The dog and the cock." What we find after just a cursory analysis is that the elements of the story (facts, actions, presuppositions, and so on) must be relativised with respect to the reader. In other words, the comprehension process and goal should be defined not in terms of propositions of the form, P, but in terms of propositions of the form, Reader-believes (P). Furthermore, many of the reader's beliefs are in turn beliefs about beliefs of the characters. The reader must recognize, for example, that the Fox believes that he wants to convince the Cock that the Fox wants the Cock as a guest for breakfast (and not as the main course). Thus, we need to represent a proposition of the form, Reader-believes (Fox-believes (Fox-wants (Cock-believes (Fox-believes (Fox-wants (P)))))), where P is "the Cock comes as a guest for breakfast."

Figures 3 and 4 show a partial, and somewhat superficial analysis of segments 8-12 of "The dog and the cock." In fact, it shows only propositions that are embedded within the reader's beliefs about the fox's beliefs about the fox's wants. A complete analysis would show the reader's beliefs about the dog's and the cock's beliefs, as well as the reader's "absolute" beliefs. In this story, as in many others, part of the interest lies in the discrepancies among

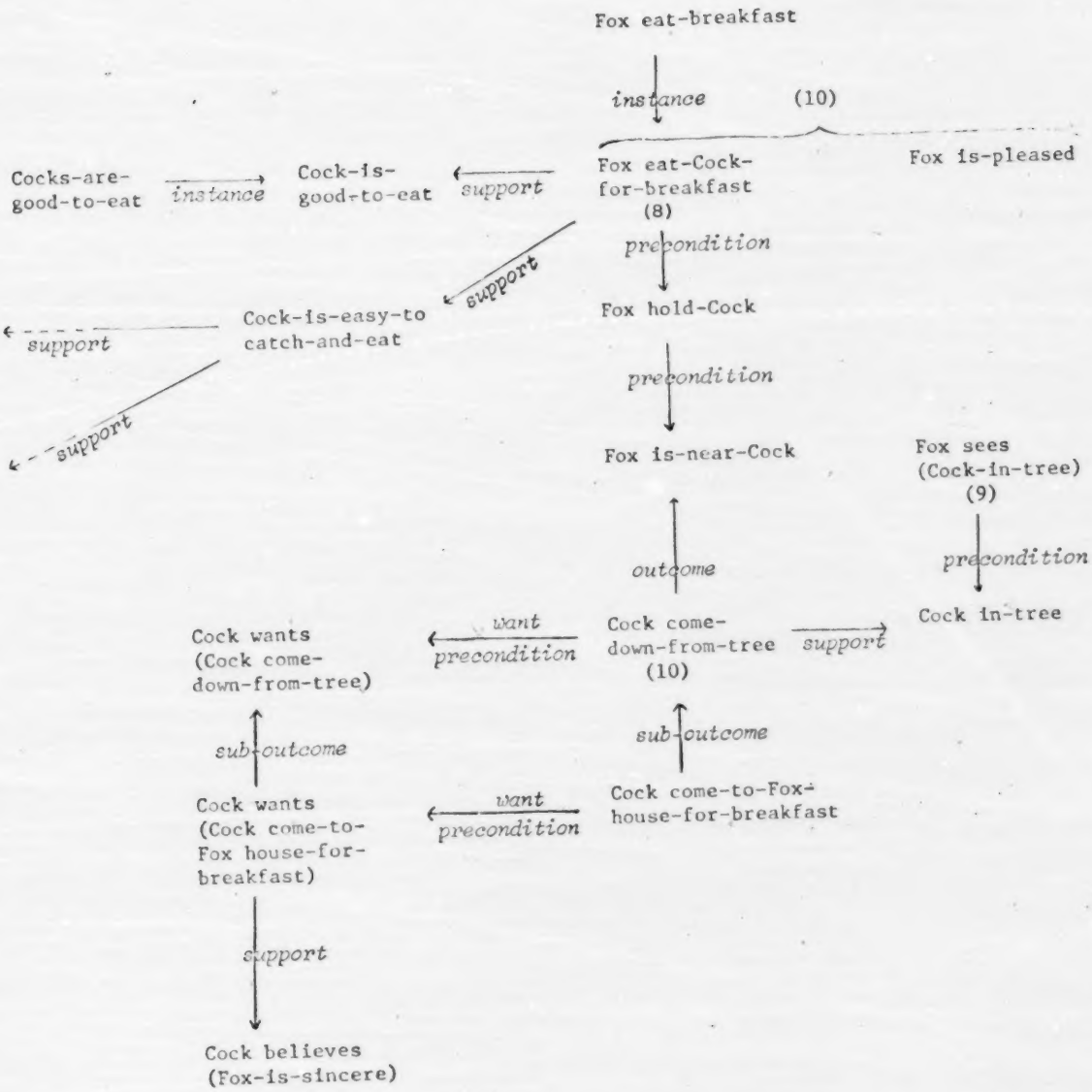

Fig. 3. A portion of a plan and social analysis of segments 8-10 of "The dog and the cock."

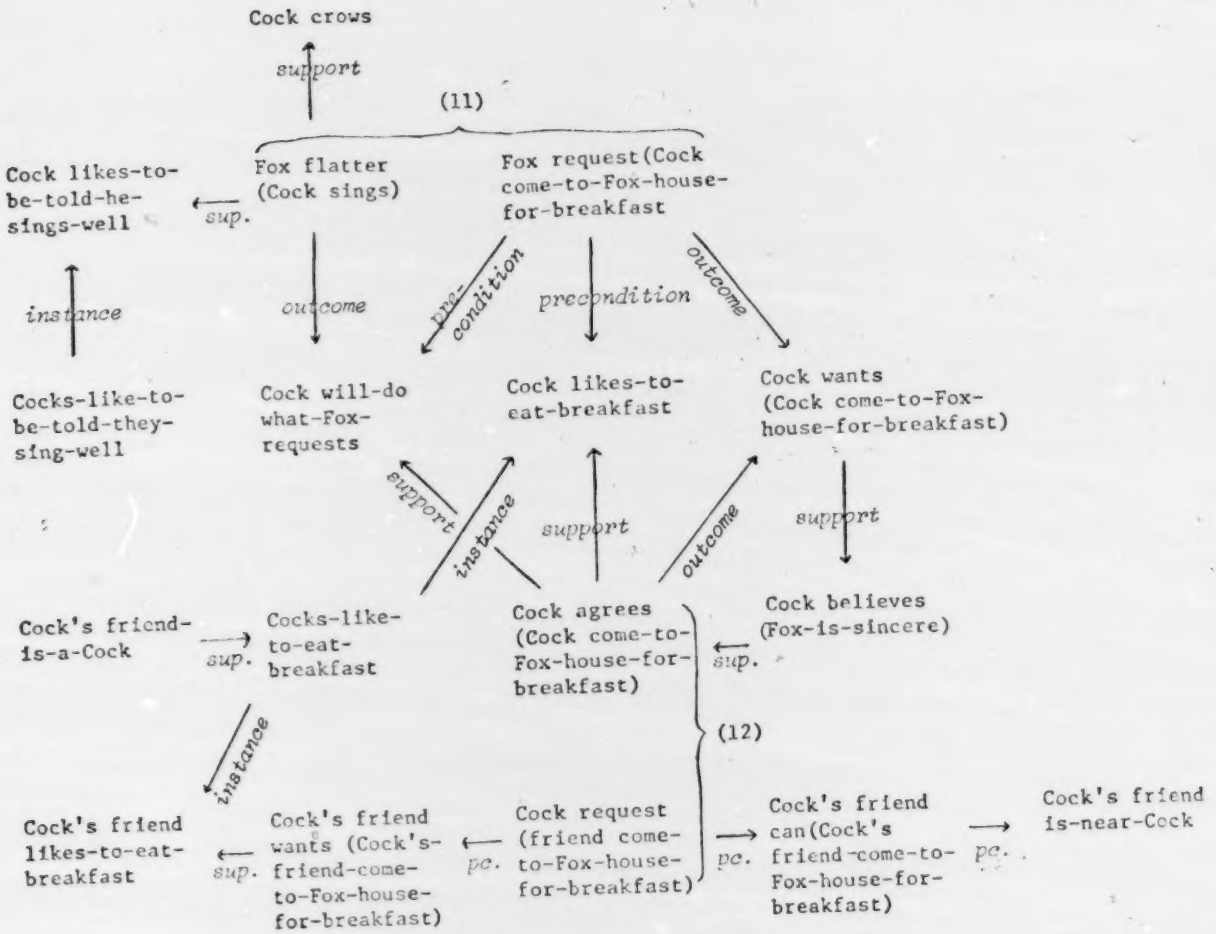

Fig. 4. A portion of a plan and social action analysis of segments 11-12 of "The dog and the cock."

the reader's model of the world (that is, the world defined in the story), and his or her models of the characters' models. Here, it is critical for the reader to recognize differences between the fox's model (as shown in Figures 3 and 4) and the cock's.

To take just one example, consider the belief, "Cock is-easy-to-catch-and-eat", as shown in Figure 3. The support for this belief is not shown in the figure, but we might hypothesize that it consists of at least the two beliefs, "lost-animals-are-easy-to-catch-and-eat" and "Cock is-lost-in-woods." The fox's subsequent actions are most easily interpreted in terms of his belief that he can easily catch and eat the cock. Conflict in the plot is provided by the belief that the cock believes otherwise.

The fox's belief that the cock will be easy to catch provides support for his top-level want, "Fox eat-Cock-for-breakfast." This want becomes the impetus for the fox's actions. As readers we might imagine that he begins to formulate a plan as follows:

(1) In order to eat the cock, he must be holding him;

(2) therefore the cock must be nearby;

(3) this will happen if the cock descends from the tree;

(4) he will come down if he wants to;

(5) he will want to if he wants to join the fox for breakfast;

(6) he may want to do that if he trusts the fox and if the fox asks him nicely;

(7) the asking will be more successful if it is accompanied by flattery.

Based on this plan (or belief based hypothesis about attaining the goal), the fox acts by saying,

> "What a fine cock you are! How well you sing! Will you come to my house for breakfast?"

Note that these utterances make sense only if we recognize a plan of the sort sketched in (1)-(7) above. Furthermore, recognition of this plan reinforces a classic schema about foxes in fables, i.e., that they are clever and deceitful, but often not clever enough.

In addition to formulating his own plans, the fox must simulate the plan formulation of the cock in order to account for the cock's actions. Figure 4 shows a portion of the beliefs he might have about the cock's plans. Note that (from the fox's point of view) the cock's actions are both understandable and desirable. Thus the fox believes his

deception is working, a belief essential to the development of the plot.

Figures 3 and 4 do not show even all of the fox's beliefs. For example, one path to the belief that the cock's friend is a cock is shown, but the fox could also infer this from the principle of quantity [Grice, 1975]:

(1) The friend of a cock is a cock (so the fox believes);
(2) a different kind of friend would be highly unusual;
(3) one should include in an utterance (or conversational turn) highly unusual, yet relevant information (the quantity principle);
(4) without contrary indications, the cock can be assumed to be following the rules of conversation.

This method of analysis is clearly not story analysis, but story model analysis; that is, we analyze the model a "typical" reader constructs for the story. Ideally, we would like to be able to analyze a particular reader's model and compare it to other models. The representation makes it possible to look for differences in beliefs to account for differing interpretations.

There are other important advantages to this approach. It allows explicit representation of the beliefs supporting a plan, and thus makes it possible to see how differences in beliefs account for differing plans. It also makes explicit the issue of conflicting beliefs and shows how the plans of different characters can interact. Finally, it gives a way of integrating speech acts (even multiple speech acts as in Figure 4) with other actions. One important drawback, of course, is that such an analysis is far from automatic and to be done well requires detailed examinations of stories and readers.

5. Understanding the Author's Intentions

An important step in the comprehension process is figuring out what the discourse is about and what the writer's intentions are. To some extent the writer can signal intentions via the structure of the text. However the lack of a one-to-one correspondence between text structure and purpose requires the reader to infer intentions on the basis of knowledge of the writer in much the same way as he or she infers intentions of characters in a story. Failure to understand the author's intentions can cause problems for all levels of comprehension, from that of "getting the main idea" to the subtle insights expected of skilled readers.

At the crudest level a reader must divine enough of the purpose of a passage to know what questions should be asked or what schemata to apply in comprehending. It is a commonplace observation that the best readers know more about the process they are engaged in when reading more and quickly see elements in a text in terms of their larger functional role, e.g., a descriptive passage as a stage setter. (The extent to which these abilities are automatic rather than evidence of meta-comprehension is still not clear.)

Using a version of "The dog and the cock" written in a more modern style and with syntax and vocabulary more appropriate to the middle grades, we saw a good example of the need to recognize the author's intention. One child (age 11), who happened to be a very good reader, had no trouble with the story, recognizing easily the flattery and trickery aspects of the plot. He volunteered a description of a schema for foxes in stories of this type, in which the fox is seen to be greedy or villainous, plotting to gain his evil ends, ultimately tricking himself, etc. Furthermore, he recognized that this characterization applies not to foxes, but only to foxes in stories of this type, i.e., he knew that he was reading a particular kind of story, intended to be entertaining, perhaps to impart a moral, but not to persuade, inform, criticize, or

any of a number of other social actions an author could be performing. A second child (age 10), who happened to have had trouble with previous stories, had difficulty with this one as well. Not surprisingly, she gave little indication of knowing either the fox schema mentioned above, nor that schema as instantiated by this story. We can only speculate about the reasons for the differing abilities we observed; but it is clear that understanding the purpose of the story played an important role in recognizing what higher level schemata to apply and hence to understanding the story itself.

In cases where a reader does understand adequately, the ability to perceive the author's intentions can still make the difference between minimally sufficient comprehension and deep understanding of a text. This difference has implications for the accumulation of knowledge from text, but, more importantly, for motivation and development of critical reading, writing and thinking. One example (from a technical article) should illustrate the skill that is needed; we can say little at this time however, about how a reader acquires this skill.

In the article, the author states that a particular theory of semantics is perhaps useful for the computerization of language but not as part of a general theory of language.

Some readers of this article interpreted the statement (and the supporting discussion) as a suggestion, i.e., that the author was distinguishing two possible applications of the theory he was discussing, and then suggesting the more appropriate application. A discussion held among several people who read the article concluded with a contrary interpretation. The statement was seen, not as a serious suggestion, but rather (or more importantly) as a criticism. The readers, applying their beliefs about the beliefs of the author and the creators of the semantic theory, concluded that the statement was saying that the purported general theory could be applied only in the "vain" attempt to computerize language. Their beliefs about the author's beliefs indicated that this would be a quite damning criticism, and not just a friendly suggestion.

The issue is not whether these readers were correct, for a text can always be re-interpreted in the light of different beliefs. The important points are (1) the group discussion convinced several readers that the criticism interpretation was more valid, thus enriching their understanding of the article, and (2) in order to reach the criticism interpretation they had to apply a great amount of knowledge about the author, his use of a word like "computerize," and

his purpose in writing. A general theory of reading comprehension should ultimately give an account of this process, a process in which the structural and context-free (if such there be) meaning aspects of language are embedded in the social function the language serves.

6. Implications for Teaching

We simply do not know the extent to which children may differ in their understanding of social actions and plans, but early work [Hall, in press] suggests that cultural differences in terms of function may be greater than phonetic, syntactic or semantic differences; furthermore, that serious comprehension difficulties can result when there is a mismatch between the understandings of a writer and those of a reader. A test designer must work under the primary assumption that an "error" may reflect differences between the reader and the writer regarding what counts as a given social action or what prerequisites there are to inferring a particular goal.

If it is true that we can best understand a linguistic act (whether spoken or written) as a social action, then an adequate test of reading comprehension should distinguish between a reader's skill at building a model for a text and his or her knowledge of social roles, social behavior

patterns, and the relevant linguistic conventions. It is also important for the test to identify differences between the writer's and the reader's beliefs about the world. That most reading comprehension tests ignore these issues is a statement on the potential cultural bias inherent in the tests. It may also provide an explanation for the limited success of attempts to select "culture-free" items for tests.

The discussion above might suggest that we teach about social actions and plans directly. A better idea would be to encourage a child to treat written language as the skilled reader does, as a tool with a purpose. This leads one to ask questions such as: What is the author trying to say? What makes you think so? Is the text convincing?

Skilled readers do not look for details without reasons, yet that is often suggested implicitly by exercises such as "find the three causes given by the author." We should instead be asking the student to find his or her interpretation of a text and then to support that interpretation, stating details where appropriate. The end may be the same, but the means reflect profoundly different conceptions of what reading is all about.

Similarly, a student should not just look for actions of characters in a story but for why characters act as they do. This suggests a de-emphasis of training for literal comprehension. It may be easier to teach and assess literal comprehension but skilled reading demands going beyond that, and may even be hampered by an over-reliance on the explicitly stated actions and beliefs in a story.

7. Further Research

The issues discussed in this paper are only beginning to be explored. We are not much beyond the anecdotal stage in describing how prior beliefs and organizing schemas are used in recognizing plans. We can say even less about how people manage the complex hypothesis formation task they are given by a story or dialogue.

We do know some ways of dealing with complexity of this sort. One can store frequently used patterns, i.e., "Can you ... ?" often signifies a request for action and not information about ability. But how are these conventions learned? How do we know when one has failed? What are the forms for the discourse rather than the sentence, level?

The models discussed herein stress the building of representations for the plans and beliefs of characters in stories and for those of authors. As such, they explain a lot about connectivity of discourse and suggest accounts of many reading comprehension difficulties. But how do we examine a person's beliefs, not to mention their beliefs about the beliefs of others? If a person builds the "correct" model for a text we may be able to discover that, but incorrect models may rest on beliefs that are obscure even to the reader.

All this says only that we should not over-simplify the issues. We need research on how children first learn and use language, especially on their models of language function. We need better analyses of texts that consider more directly the alternative readings implied by different beliefs. We should study the beliefs that children have about social relationships and the use of language. We also need more work on how the apparently well developed skills children have for oral discourse transfer to, interfere with, or are orthogonal to the corresponding skills for written material. Finally, we need a better model of how knowledge about linguistic forms, prose structure, social relationships and purposeful action can be integrated to impose structure on a text.

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